

Luis Duran, ABB

# Safety backbone of groundbreaking companies

## Competence, procedures and technology

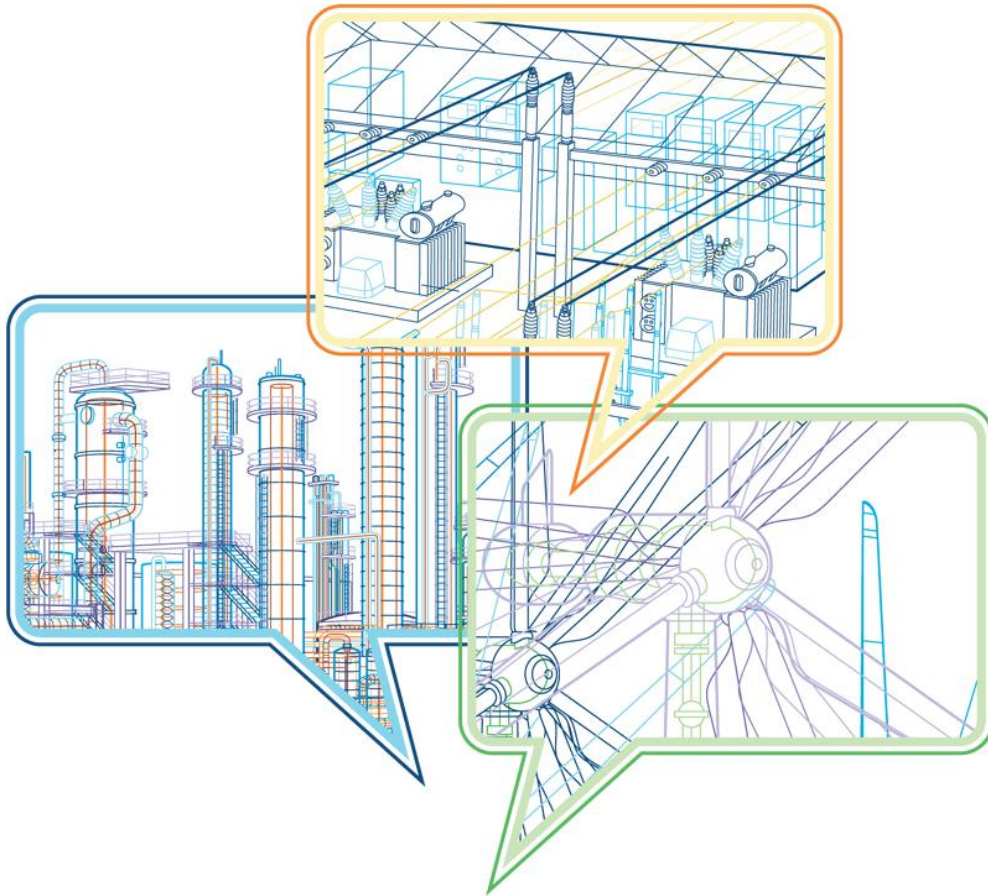
# Automation & Power World 2011

April 18-21, 2011 in Orlando, Florida



# Automation & Power World 2011

## April 18-21, 2011 in Orlando, Florida



- Save the date for this “must attend” event!
- April 18-21, 2011
- Orlando World Center Marriott, Florida
- Over 400 hours of educational training
  - Business forum
  - Customer case studies
  - Hands-on training
  - Panel discussions
  - Technical workshops
- Earn PDHs and CEUs
- Technology & Solution Center
  - Over 70,000 sq. ft. of exhibits
- Network with your peers
- [www.abb.com/a&pworld](http://www.abb.com/a&pworld)

# ABB Automation & Power World

## At-a-glance

400+

### Educational Workshops

Automation & Power World offers over 400 hours of Educational Workshops specifically designed to make engineers, maintenance and management more valuable to their companies.

70K

### Technology & Solution Center

Over 1 ½ acres (70,000 ft<sup>2</sup>) of with nearly 100 tons of electrical gear and 100's of experts ready to answer any of your questions and share the future of Automation & Power Solutions.

4,000

### Connect with Peers

With over 4,000 of your peers in attendance, this is a powerful opportunity to network and learn from the industry. In addition, over 45 customers will be sharing their own case studies.

# Educational workshops developed for all audiences

## Just a few examples

### Roles

Engineering

Management

Maintenance

### Company types

Industrials

EPCs

Utilities

OEMs

- ▣ The coming wave of process safety system migration
- ▣ Implementing an alarm management strategy for a 100,000 I/O system - Case study
- ▣ Replacement and retrofit of large motors: Challenges and solutions
- ▣ Dynamic studies for large scale renewable energy integration at a Texas CREZ - Case study
- ▣ Secure commissioning of your process plant - Case study
- ▣ New arc flash mitigation technologies and techniques for a safer working environment
- ▣ Robotics 101
- ▣ A better approach to non-revenue water loss
- ▣ Electric vehicles: Are they real this time?
- ▣ Why is SIL more important than architecture?

# Past attendees input



“I am impressed with the different parts of the program, the workshops and also the exhibit set-up... there is a lot of information to pick up.”

**Duane Souers, Georgia Pacific**

“It’s a great opportunity to get a lot of exposure to people and products in one week.”

**Pardeep Gill, Alcoa**



“It is well worth the time given the opportunities to: learn from industry experts, network with peers in the same industry, learn about emerging technologies, and build excellent supplier relationships.”

**Sanjin Osancevic, National Grid**

# Speaker Bio

- 📄 Speaker name: Luis Duran
- 📄 Speaker title: Business Development Manager Safety Systems Americas
- 📄 Company name: ABB Inc.
- 📄 Location: Houston, Texas

# Agenda

- 📄 Safety Culture
- 📄 Accidents and Incidents
- 📄 Measuring Maturity
- 📄 KPIs
- 📄 Processes
- 📄 Technology
- 📄 Support
- 📄 Conclusions





# What is Safety Culture?

- ❏ Term introduced in 1986 after Chernobyl
- ❏ Proficiency and the style of, an organization's health and safety management.
- ❏ Commitment to an organization's health and safety management.
- ❏ Product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior

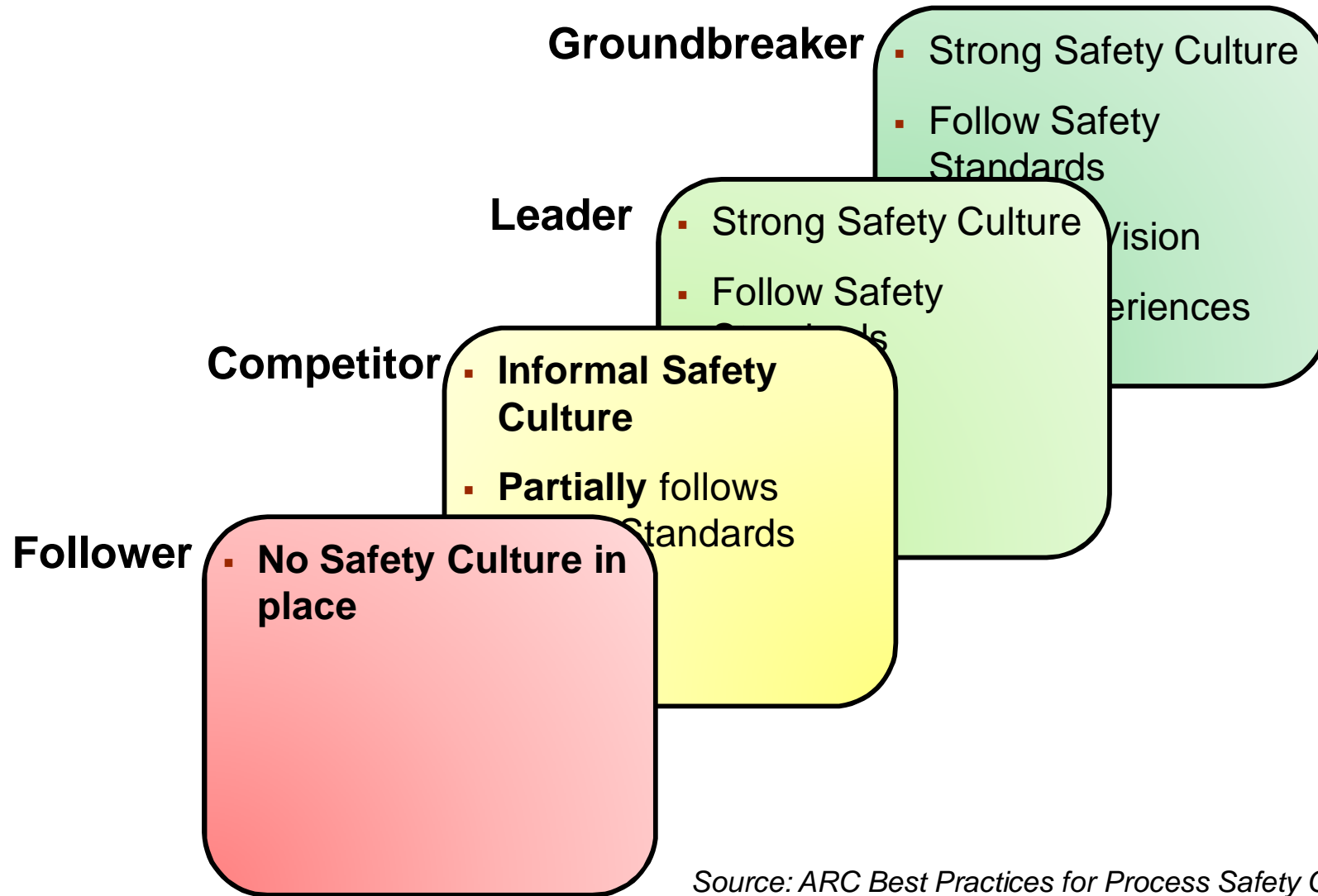
Organizations with a vigorous **Safety Culture** are in a more secure position to **Avoid Accidents** and better prepared when an incident happens

# What type of Accidents or Incidents?



- 📄 A simplifying but potentially unsafe shortcut...  
...can develop a serious hazardous situation

# Measuring Safety Culture Maturity



Source: ARC Best Practices for Process Safety Culture July 2007

# Safety Culture Key Performance Indicators

- ▣ ARC identified 4 key performance indicators to describe Best Practices for Process Safety
- ▣ Groundbreaking companies are differentiated by the adoption of a Safety Culture reflected on those 4 KPIs
  - ▣ People
  - ▣ Processes
  - ▣ Technology
  - ▣ Support

Commitment to a  
Formal and Fully defined  
Safety Culture Vision  
part of Day to Day Operations

*Source: ARC Best Practices for Process Safety Culture July 2007*

# Processes



- ❏ Safety is part of Operational Excellence.

- ❏ Periodic Safety Audits

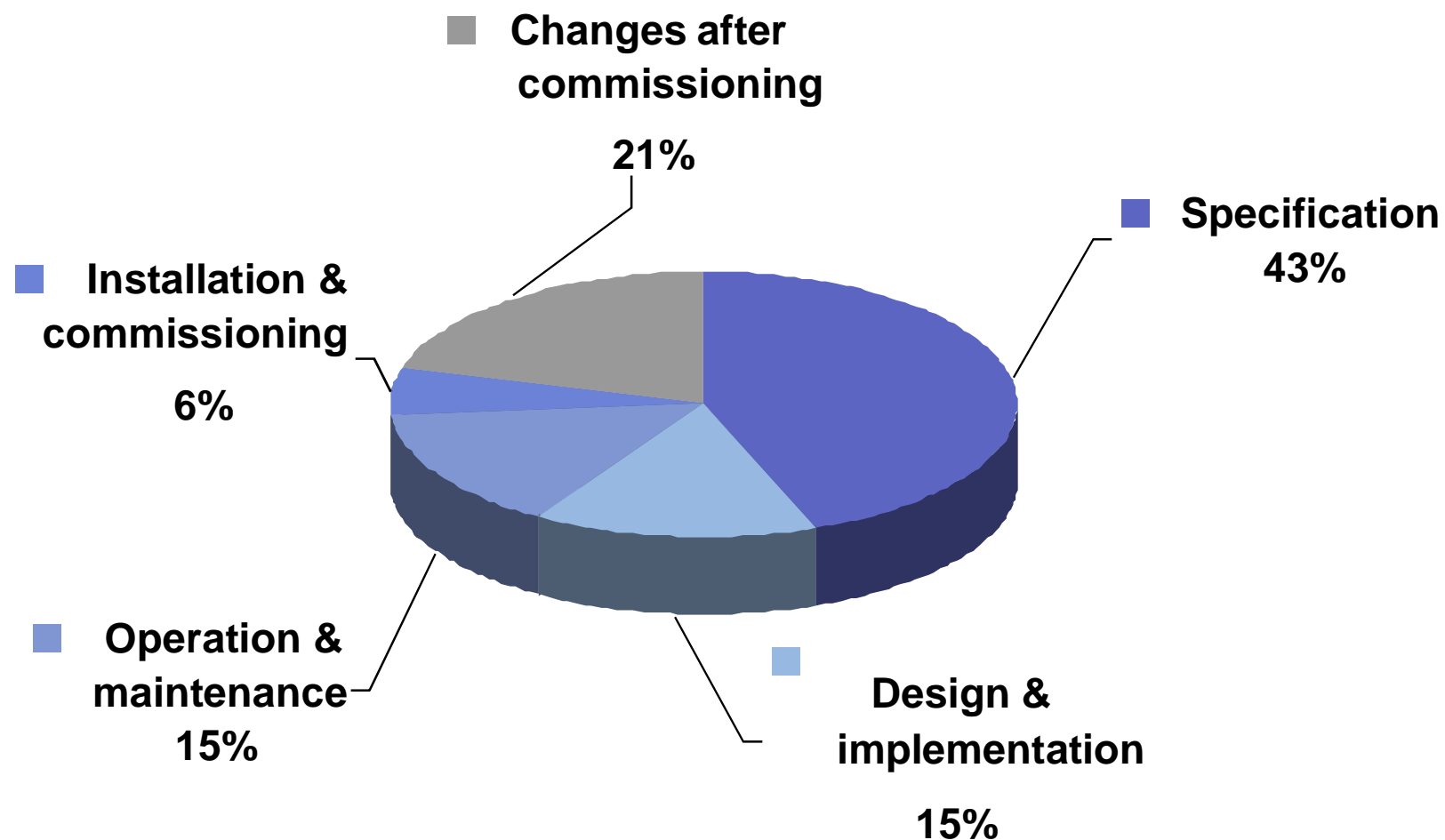
- ❏ Preventive Maintenance is part of Safety Culture

- ❏ Follows Safety Standards and Lifecycle Management

- ❏ Clear procedures to handle safety complaints

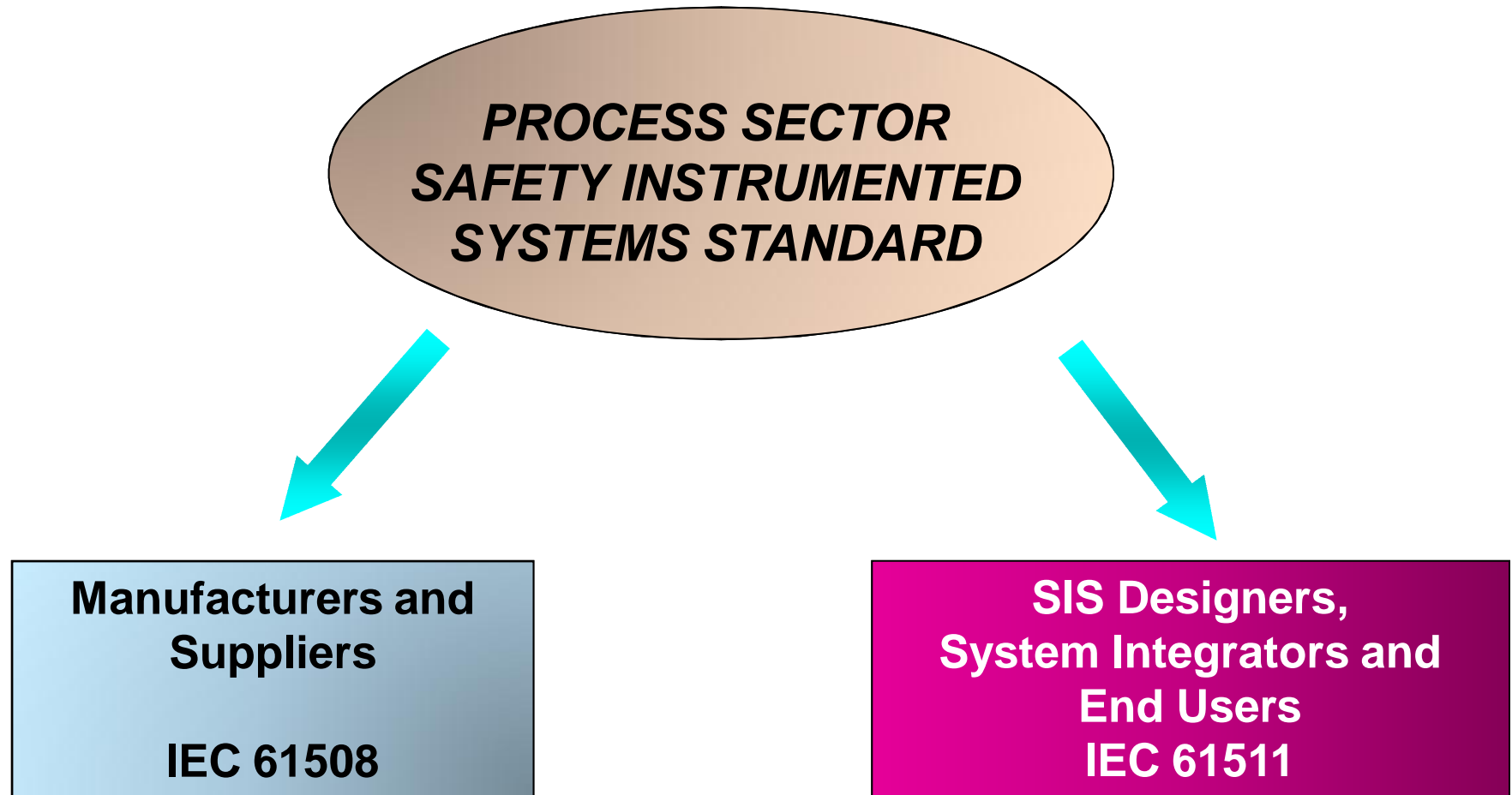


# Primary Cause of Control System Failure



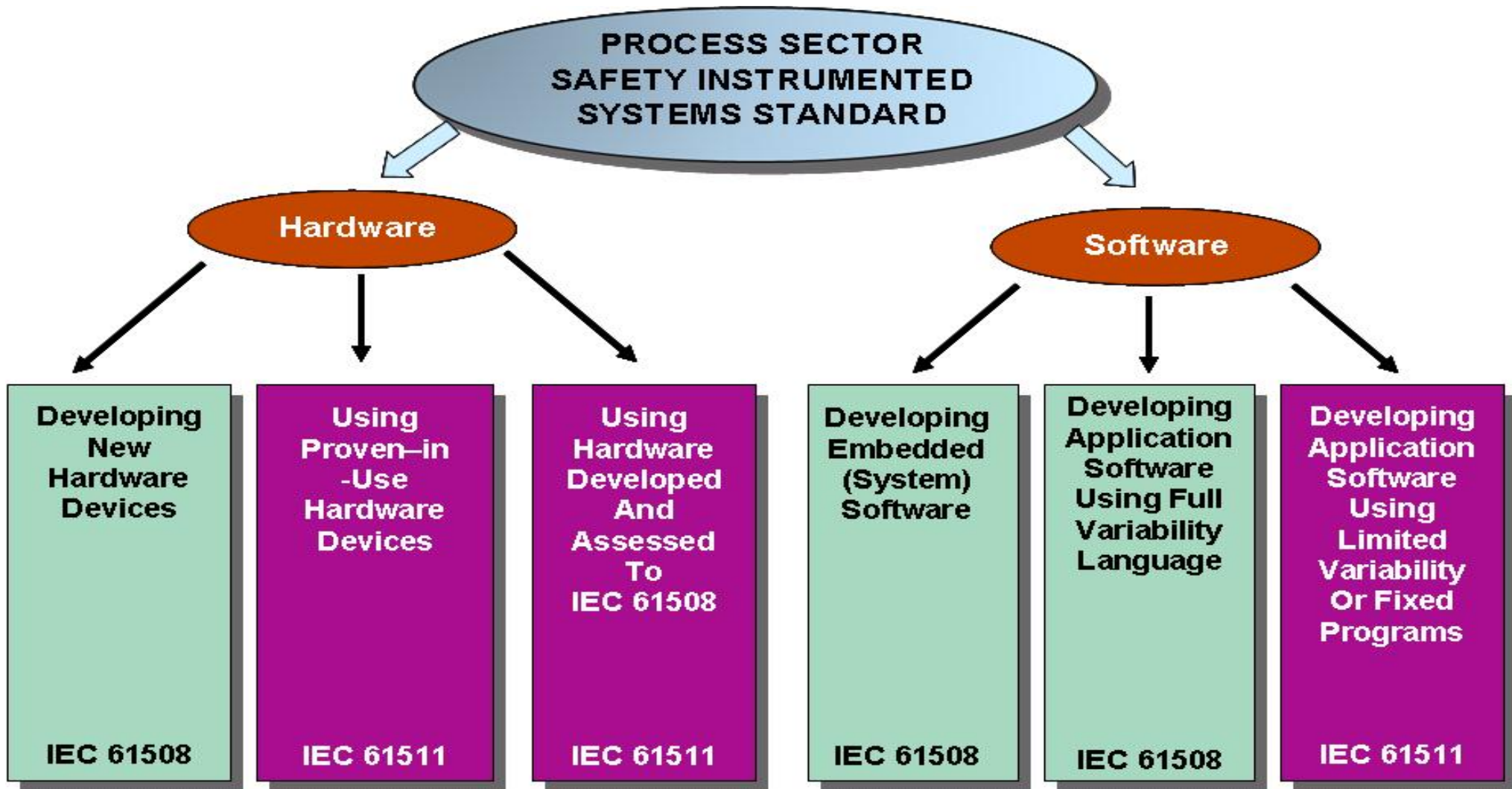
Source: *Out of control: Why control systems go wrong and how to prevent failure* HSE Books 2009

# Follow Safety Standards: IEC 61508 and IEC 61511 (ISA84)



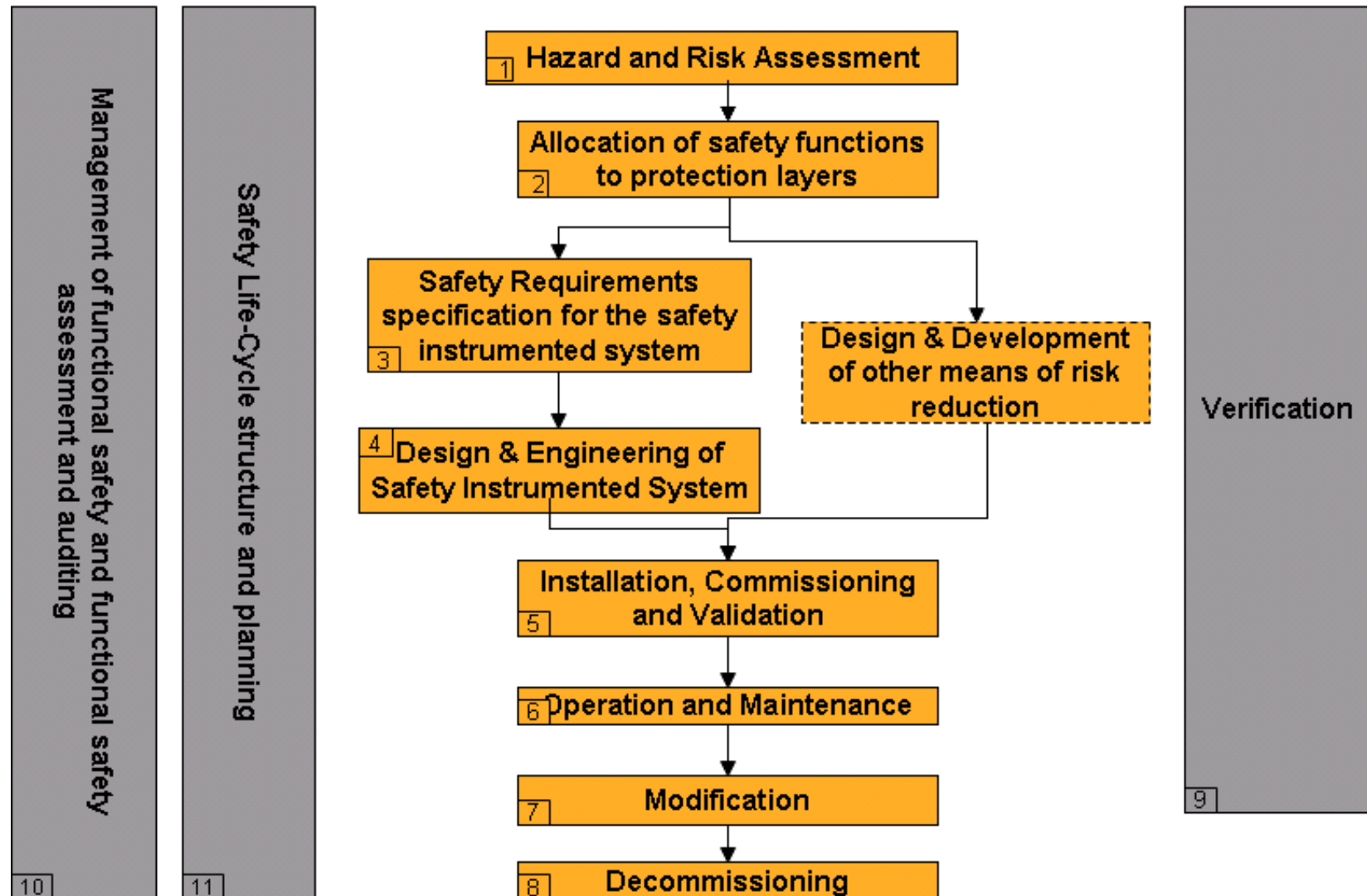
# Applicable Safety Standards

## IEC 61508 and IEC 61511(ISA84)





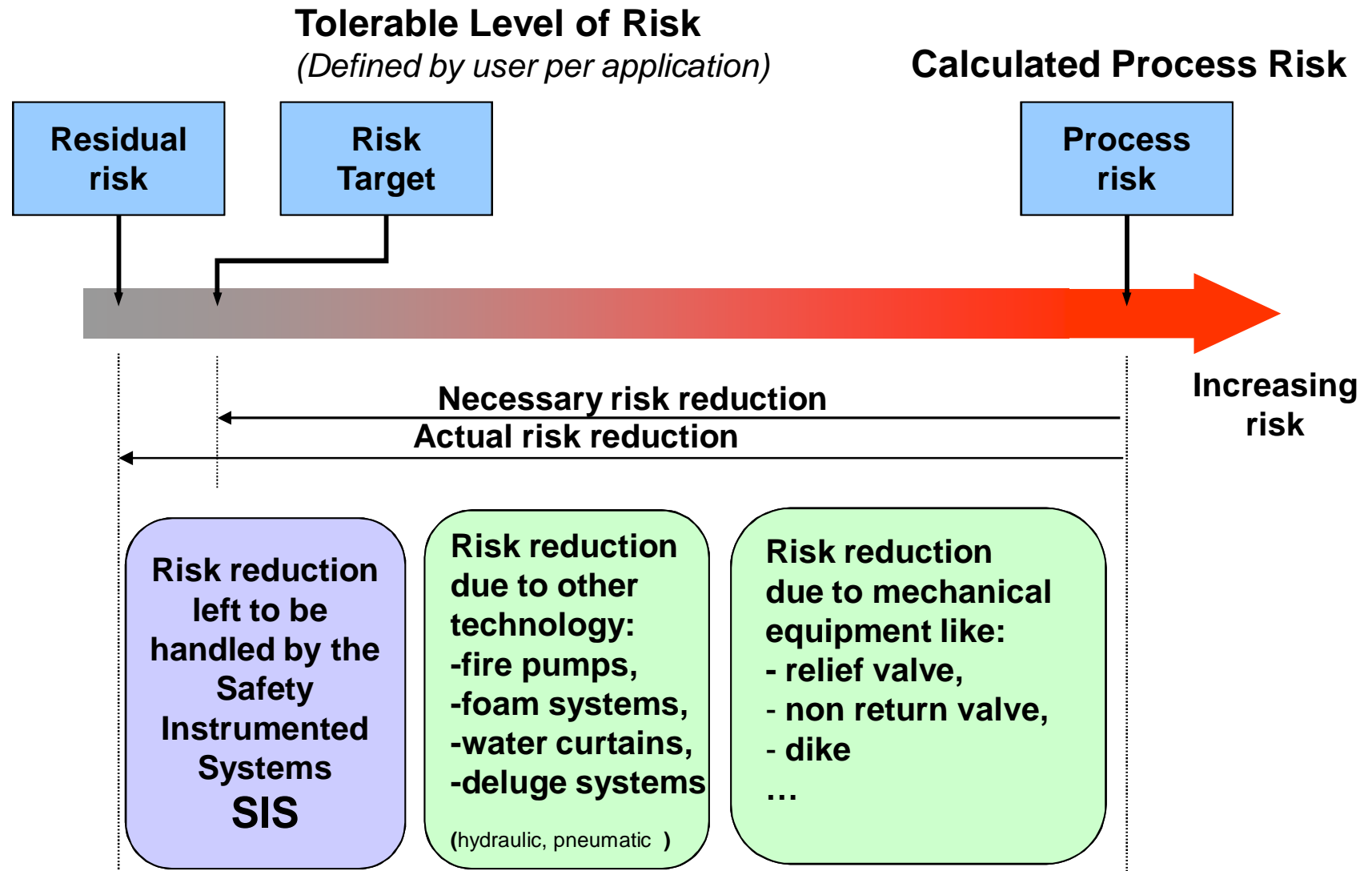
# Follows Lifecycle Management: IEC 61511 Safety Lifecycle



# Technology

- 📄 Formal hazard assessment is performed after every incident or accident
- 📄 Process equipment, control systems and safety systems are regularly tested and maintained
- 📄 Written standards and operational procedures are followed and maintained
- 📄 Safety Blog

# Inherent Safe Design is the beginning



# Risk Graph Technique – Target SIL

**Safety Integrity Assessment**

Assessed SILs  
 Safety:  
 Envir: Not Assessed  
 Asset: Not Assessed  
 Off-Site: Not Assessed

Safety - Custom

Scenario  
 Overpressure of the Buffer Vessel leading to rupture and ignition of flammable material,

	W3	W2	W1
-	-	-	-
a	-	-	-
a	a	-	-
1	a	-	-
2	1	a	-
-	-	-	1
4	3	2	-
b	4	3	-
b	b	b	-

**SIL 1**

Save  
 Undo  
 Done  
 Help

Assessment Justification... **ABB recommend that a more detailed SIL assessment should be performed.**

Safety: Safety impact (1) | Envir: Environmental impact (2) | Asset: Asset or Production loss (3) | Off-Site: Off-Site (4)

Consequence of trip failure

- NA Not assigned
- Ca Minor Injury
- Cb Lost time injury
- Cc Major injury
- Cd On-site fatality
- Ce Multiple on-site fatalities or one off-site fatality

... Cc Major Injury - Most likely safety Consequence of a pool fire

Probability of exposure if the hazardous event occurs

- NA Not assigned
- Fa Rare to Occasional exposure in the hazardous zone (less than 10%).
- Fb Frequent to Permanent exposure in the hazardous zone (occupancy 10 to 100%).

... Fb - Operators normally present 10% of the time

Probability of avoiding the hazardous event

- NA Not assigned
- Pa Possible under certain conditions (only if defined conditions are satisfied)
- Pb Almost impossible to avoid

... PB Almost impossible - if protection fails operators cannot intervene in time

Frequency of demands on instrumented protective system

- NA Not assigned
- W1 \* Demand frequency less than 0.03 per year (>33 years)
- W2 Demand frequency between 0.3 and 0.03 per year (3 to 33 years)
- W3 Demand frequency between 3 and 0.3 per year (4mths - 3 years)

... W1 - 1 event in 5 years but did not burst vessel, so perhaps less than a 1 in 10 chance the relief valve would fail so less than 0.02 per year

# Technology

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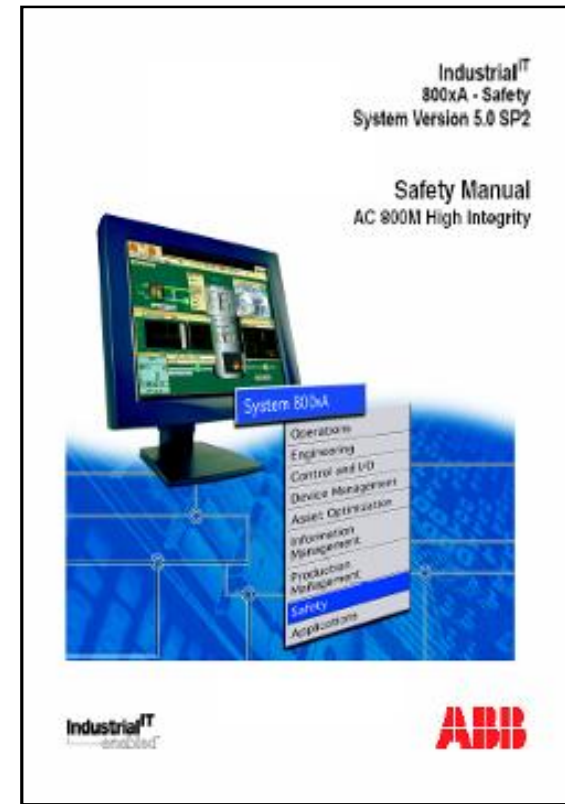
# SIL 3 Certification by TÜV 800xA High Integrity – ABB Safety Certificates



**Product Safety  
Certificate**



**Development Department  
Safety Certificate**

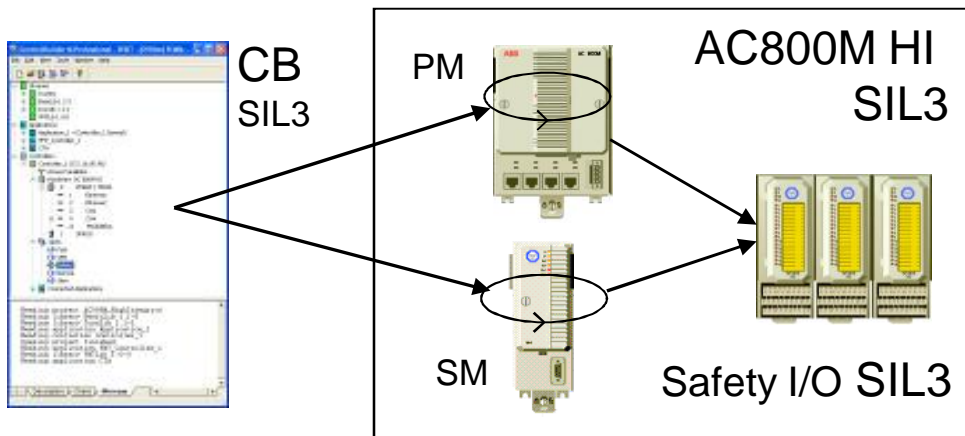


**Safety Manual**

TÜV Product Service GmbH, has certified all product components on the 800xA Safety offering

# 800xA High Integrity



## Diverse Architecture, Diverse Implementation



- ☐ The SIL 3 800xA High Integrity controller has parallel processing paths based on diverse technology
- ☐ Integrity voting between paths compliments the built in active diagnostics
- ☐ Controller and Supervision Module developed by diverse (different) teams (Vasteras and Malmo, Sweden) and tested by a third team (Oslo, Norway) by people with different backgrounds
- ☐ The two channel architecture meets SIL3 requirements for hardware fault detection and reaction

	HFT	
SFF (%)	0	1
< 60	—	SIL 1
60 - 90	SIL 1	SIL 2
90 - 99	SIL 2	SIL 3
> 99	SIL 3	SIL 4

	
1001D	1002D

IEC61508-2 Table 3

# Safe Failure Fraction (SFF) on 800xA HI

- Modern design techniques allows the AC800M HI achieve near 100% diagnostics coverage without needing to resort to use HFT factors to reduce PFD
- 800xA HI Controller does not rely on voting schemes to increase the safety integrity

SFF	Hardware fault tolerance		
	0	1	2
< 60 %	Not allowed	SIL 1	SIL 2
60 % - < 90 %	SIL 1	SIL 2	SIL 3
90 % - < 99 %	SIL 2	SIL 3	SIL 4
≥ 99 %	SIL 3	SIL 4	SIL 4

IEC 61508-2, Table 3



# Systematic Safety Integrity – 800xA HI



- ▣ Application of rigorous TÜV certified Functional Safety Management in every stage of the hardware and software development process

- ▣ V-Model

- ▣ Coding Guidelines

- ▣ Independent Development And Validation Teams

- ▣ Etc...

- ▣ Embedded Diversity

- ▣ Diverse application execution engine in PM and SM

- ▣ Diverse architecture (MCU & FPGA) in I/O modules



# Support Empowerment and Training



- 📄 Worker Empowerment
- 📄 Encouraged to report on safety issues
- 📄 Active participation on safety policies, hazard reviews, accident investigations...
- 📄 Safety Training
- 📄 Adequate training all new employees and refresher courses to the veterans.

All personnel involved with safety systems shall be sufficiently competent

competent

competent

# Conclusions

- 📄 Groundbreaker companies are committed to a fully defined Safety Culture and has made an integral part of day to day operations
- 📄 Organizations with a vigorous Safety Culture are in a more secure position to Avoid Accidents and better prepared when an incident happens
- 📄 Follows Safety Standards and Lifecycle Management
- 📄 Performs Formal Hazard Assessment after every incident or accident
- 📄 Process equipment, control systems and safety systems are regularly tested and maintained
- 📄 Employees are encouraged to report on safety issues
- 📄 All personnel involved with safety systems shall be sufficiently competent in Functional Safety as appropriate to their job function

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# Workshop Statistics

## Over 400 hours of training

- 📄 ~45 customer presented case studies
- 📄 87 sessions in the Technology and Solution Center
- 📄 11 hours of panel discussions consisting of customers, industry experts and ABB executives
- 📄 Nearly 50 hours of hands on Technical Training

# ABB Automation & Power World Registration options

	Full Conference	Courtesy Registration
Access to ABB product developers and application experts in the 70,000 ft <sup>2</sup> (over 1.5 acre) Technology & Solution Center		
Access to a series of complimentary and educational workshops.		
Free Lunch and Tuesday Evening Reception		
Access to over 300 additional educational workshops – Including ARC Analysts presentations		
Up to \$1,500 off a future ABB purchase*		
Complimentary ARC report valued at \$2,500!*		
Evening Events (Monday and Wednesday)		
* See <a href="http://www.abb.com/a&amp;pworld">www.abb.com/a&amp;pworld</a> for more details	<b>Cost</b>	<b>Free!</b>
	\$300 per day or \$800 for all three days.	

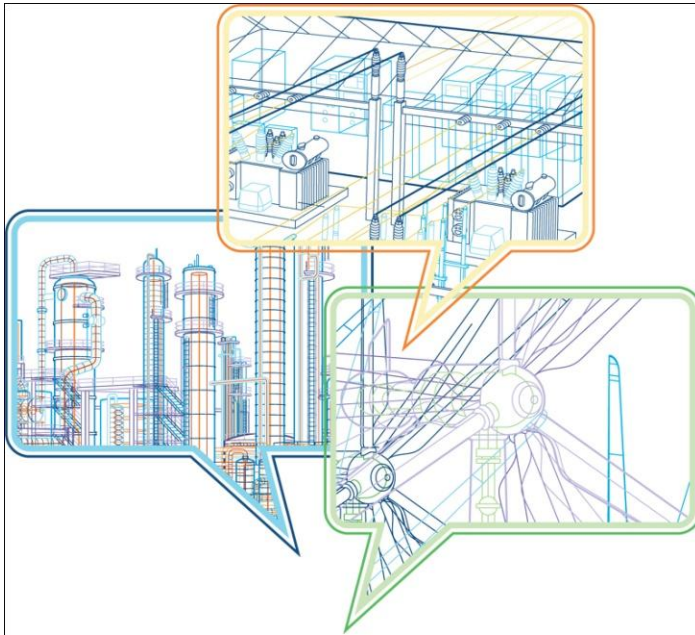
# Top ten reasons to attend



- Become more valuable, choose from over 400 educational workshops and hands-on training sessions
- Connect with thousands of peers and industry experts from 40 countries
- Ask questions of, and give feedback to, ABB product developers and executive management
- Get up to date with new and emerging technologies and industry trends
- Learn how to maximize the value from your existing assets
- Discover how to improve grid reliability, energy efficiency and industrial productivity
- Apply lessons learned from over 45 customer-presented case studies
- Focus on critical non-technical issues facing your company in the business forums
- Succeed professionally by earning CEUs on select workshops and PDHs for every workshop you attend
- See the widest range of technologies from one company at one conference!

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